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[Title of the Invention] EXCHANGE AND COMPUTER
READABLE MEDIUM STORING EXCHANGE CONTROL PROGRAM

[Scope of Claim for a patent]

5 [Claim 1] An exchange comprising:

a part which receives a number of a
telephone terminal of a called party, and selects a
network from a plurality of connectable networks
including the Internet by a predetermined control
10 and connects to said network.

[Claim 2] The exchange as claimed in claim 1,
further comprising:

a part which calls said telephone terminal
via a network other than the Internet and connects
15 to said telephone terminal in response to a
predetermined operation by a caller during a call
via the Internet.

[Claim 3] The exchange as claimed in one of claims 1
or 2, further comprising:

20 a part which receives said number of a
telephone terminal of a called party, selects the
least expensive network from a plurality of
connectable networks including the Internet and
connects to said network.

25 [Claim 4] The exchange as claimed in one of claims
1-3, further comprising:

a part which calls said telephone terminal
via a network other than the Internet and connects
to said telephone terminal in response to dialing a
30 special number or pushing a button after an on-hook
operation by a caller during a call via the Internet.

[Claim 5] The exchange as claimed in one of claims
1-4, further comprising:

35 a part which calls said telephone terminal
via a network other than the Internet and connects
to said telephone terminal in response to dialing a
special number or pushing a button after a hooking

operation by a caller during a call via the Internet.

[Claim 6] The exchange as claimed in one of claims 1-5, further comprising:

5 a part which originates a call to said telephone terminal after switching from a route via the Internet to a route via another network when said route via the Internet is busy.

[Claim 7] The exchange as claimed in one of claims 1-6, further comprising:

10 a part which originates a call to said telephone terminal after switching from a route via the Internet to a route via another network when there is no response after a call origination via the Internet.

15 [Claim 8] A computer readable medium storing program code for controlling an exchange, said computer readable medium comprising:

20 program code means for receiving a number of a telephone terminal of a called party, selecting a network from a plurality of connectable networks including the Internet with said number and connecting to said network; and

25 program code means for calling said telephone terminal via a network other than the Internet and connecting to said network in response to a predetermined operation by a caller during a call via the Internet.

[Detail description of the Invention]

[0001]

30 [Technical Field Pertinent to the Invention]

The present invention generally relates to an exchange, and more particularly to an exchange and an exchange control program recording medium which are applicable to a call via the Internet and which have a function for switching from a call via the Internet to a call via another network.

[0002]

[Description of Related Art]

When making a call via the Internet, the charge for a call is the sum of a telephone charge to an Internet provider and a charge for the
5 Internet provider to connect to the Internet. Therefore, communications costs can be reduced substantially. Thus, it is strongly needed to use an Internet telephone system for a long-distance call and the like.

10 [0003]

Fig.1 is a diagram showing an example of a conventional internet telephone system. In Fig.1, when a personal computer of a user A originates a call to a personal computer of a user B, the
15 personal computer of the user A designates an IP address of the personal computer of the user B, connects to the personal computer of the user B and starts a call.

[0004]

20 [Problems to be solved by the Invention]

However, according to the conventional system, it is necessary to input an IP address of a called party in order to make a call via the Internet. In addition, there may be cases where
25 speech quality is degraded according to conditions of the Internet. In such a case, conventionally, a connection via the Internet needs to be disconnected and the connection is switched to a connection via a telephone network or the like by redialing manually.
30 In addition, a caller needs to know a plurality of numbers such as an IP address, a telephone number of a called party and the like.

[0005]

The present invention is contrived in view
35 of the above-mentioned fact. It is an object of the present invention to provide an exchange which can select a network from a plurality of networks only

by recognizing a number of a telephone terminal of a called party, and has a switching function for switching a network by a simple operation, and switching a route via the Internet to a route via other network without consciousness by the caller and originating a call in a predetermined case such as route busy via the Internet, and a computer readable recording medium storing a program realizing the switching function.

10 [0006]

[Means for solving Problem]

The above-mentioned problems can be achieved by the following invention.

The invention claimed in claim 1 is an exchange comprising: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps S30-S35 in the after-mentioned embodiment) which receives a number of a telephone terminal of a called party, and selects a network from a plurality of connectable networks including the Internet by a predetermined control and connects to said network. According this invention, since it becomes possible to receive a number of a telephone terminal of a called party, and select a network from a plurality of connectable networks including the Internet by a predetermined control and connect to said network, it becomes possible to connect to the called party via the Internet or, for example, via the public telephone network by supplying a telephone number of a telephone terminal. Therefore, a caller does not need to know each destination number for each network as conventionally. The caller needs to know only one number.

[0007]

35 In the invention claimed in claim 2, the exchange further comprises: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps

S37-S41 after receiving connection switching special number in the after-mentioned embodiment) which calls said telephone terminal via a network other than the Internet and connects to said telephone terminal in response to a predetermined operation by a caller during a call via the Internet. According to this invention, since a call via the Internet can be switched to one via a network other than the Internet easily by a simple operation, the caller can continue a call by switching to a call via a network other than the Internet without disconnecting a connection and redialing a number when the speech quality of the call via the Internet degrades.

[0008]

In the invention claimed in claim 3, the exchange further comprises: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps S30-S35 in the after-mentioned embodiment) which receives said number of a telephone terminal of a called party, selects the least expensive network from a plurality of connectable networks including the Internet and connects to said network. According to this invention, the exchange automatically selects the least expensive network from a plurality of connectable networks including the Internet with a telephone number of a telephone terminal of the called party. Therefore, a caller does not need to know each destination number for each network for selecting the least expensive network. The caller needs to know only a telephone number.

[0009]

In the invention claimed in claim 4, the exchange further comprises: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps S37-S41 in the after-mentioned embodiment) which

calls said telephone terminal via a network other than the Internet and connects to said telephone terminal in response to dialing a special number or pushing a button after an on-hook operation by a caller during a call via the Internet. According to this invention, since the exchange can switch a call via the Internet to a call via a network other than the Internet in response to dialing a special number or pushing a button after an on-hook operation by a caller, the caller does not need to disconnect a connection and redial a number when the speech quality of the call via the Internet degrades for performing a call by switching the network to a network other than the Internet.

15 [0010]

In the invention claimed in claim 5, the exchange further comprises: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m in the after-mentioned embodiment and steps S37-S41 after receiving special number for connection switching) which calls said telephone terminal via a network other than the Internet and connects to said telephone terminal in response to dialing a special number or pushing a button after a hooking operation by a caller during a call via the Internet. According to this invention, since the exchange can switch a call via the Internet to a call via a network other than the Internet in response to dialing a special number or pushing a button after a hooking operation by a caller, the caller does not need to disconnect a connection and redial a number when the speech quality of the call via the Internet degrades for performing a call by switching the Internet to a network other than the Internet.

35 [0011]

In the invention claimed in claim 6, the exchange further comprises: a part (corresponding to

elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps S35-S41 in the after-mentioned embodiment) which originates a call to said telephone terminal after switching from a route via the Internet to a route via another network when said route via the Internet is busy. According to this invention, when the route via the Internet is busy, since the route is switched to a route via a network other than the Internet and the exchange originates a call automatically, the caller can make a call without redialing, and start to speak.

[0012]

In the invention claimed in claim 7, the exchange further comprises: a part (corresponding to elements 30, 32, 34, 36₁ - 36_n, 38₁ - 38_m and steps S35-S41 in the after-mentioned embodiment) which originates a call to said telephone terminal after switching from a route via the Internet to a route via another network when there is no response after a call origination via the Internet. According to this invention, when the connection via the Internet can not be established due to a malfunction of the Internet and the like, since the route is switched to a route via a network other than the Internet and the exchange originates a call automatically, the caller can make a call without redialing as conventionally and start to speak.

[0013]

The exchange control program recording medium claimed in claim 8 comprises: program code means (corresponding to steps S30-S42 in the after-mentioned embodiment) for receiving a number of a telephone terminal of a called party, selecting a network from a plurality of connectable networks including the Internet with said number and connecting to said network; and program code means (steps S37-S41 after receiving special number for

connection switching) for calling said telephone terminal via a network other than the Internet and connecting to said network in response to a predetermined operation by a caller during a call via the Internet. Since this invention includes above-mentioned means, the above-mentioned problem can be solved in an exchange storing this program. [0014]

[Mode for Carrying out the Invention]

Fig.2 is a block diagram of a communication system according to a first embodiment of the present invention. As shown in Fig.2, a telephone terminal 26 of a user A is connected to an exchange 10. The exchange 10 is connectable to a personal computer 22 of a user B via an Internet gateway 16 and the Internet 18. And also, the exchange 10 is connectable to a telephone terminal 24 of the user B via a public telephone network 20. The exchange 10 includes a trunk 12 which is connected to the Internet gateway 16 and a trunk 14 which is connected to the public telephone network 20. In addition, the exchange 10 includes an control function and a switch part 30 (SW). The control function (to be referred to as LCR control function hereinafter) selects the least expensive route. [0015]

When the telephone terminal 26 of the user A dials a telephone number (123-4567) of the user B and the exchange 10 selects a route via the Internet 18 by the LCR control function, the telephone number of the user B (123-4567) is converted to an IP address of the user B at the Internet gateway 16. As a result, the telephone terminal 26 of the user A starts a call with the personal computer 22 of the user B. When a good speech quality is not obtained according to conditions of the Internet 18, the

connection route is switched to a route via the public telephone network 20 (K1) by a simple operation (which will be described later) at the telephone terminal 26 of the user A, and a call is
5 originated. Additionally, when the same operation is performed during a call via the public telephone network 20, the connection is switched to the route via the Internet 18 (K2) and a call is originated.
[0016]

10 Fig.3 is a block diagram of the exchange 10 and the Internet gateway 16 shown in Fig.2. The exchange 10 includes trunks $36_1 - 36_n$ which are connected to the Internet gateway 16 and trunks $38_1 - 38_m$ which are connected to the public telephone
15 network 20. In addition, the exchange 10 includes the switch part (SW) 30, a control part (CC) 32 and a memory (MM) 34. The control part 32 includes an LCR control part 32_1 , a switch control part 32_2 , and a re-origination control part 32_3 . The LCR control
20 part 32_1 selects the least expensive network. The switch control part 32_2 controls switching from a network to another network. The re-origination control part 32_3 controls an operation for re-origination. The memory 34 stores information of
25 routes of the Internet and the public telephone network. The Internet gateway 16 includes a line interface 40, a voice converter 42 and a destination number/IP address converter 44. The line interface 40 is connected to the trunks $36_1 - 36_n$. The voice
30 converter 42 is connected to the line interface 40 and the destination number/IP address converter 44 is connected to the Internet 18.
[0017]

Fig.4 is a diagram of a software
35 configuration in the Internet gateway 16. The software of the Internet gateway 16 performs processes necessary for a voice call via the

Internet. As shown in Fig.4, the software of the Internet gateway 16 includes an interface part 50 which connects to the Internet and the like, a voice processing part 52 which converts voice data to packets, a communication protocol processing part 54, a device driver 56, a voice processing management part 58 which manages voice processing, a line management part 60 which manages a line, a connection control part 62, an application part 64 and a database part 66 which stores and manages call information. The communication protocol processing part 54 processes communication protocols such as TCP/IP, H.323 and the like. The interface part 50 and the voice processing part 52 are realized by hardware. Other parts are realized by software.

[0018]

The outline of the operation of the configuration shown in Fig.3 is as follows. When the exchange 10 receives dial information (123-4567) of the user B from the telephone terminal 26 of the user A, the LCR control part 32₁ selects a route of the lowest charge with reference to data in the memory 34. As a result, if the route via the Internet 18 is selected, the exchange 10 selects a trunk among the trunks 36₁ - 36_n which are connected to the Internet gateway 16. When the Internet gateway 16 receives the dial information (123-4567) from the exchange 10, the Internet gateway 16 converts the dial information into an IP address of the personal computer 22 with the destination number/IP address converter 44, and sends the IP address to the Internet 18. Thereby, the Internet gateway 16 is connected to the personal computer 22. In addition, the voice converter 42 converts voice data into IP packets such that the telephone terminal 26 can communicate with the personal computer 22.

[0019]

When the exchange 10 receives, from the telephone terminal 26, a request for switching to the route via the public telephone network 20, the exchange 10 disconnects the connection to the Internet gateway 16 by using the switch control part 32₂ of the control part 32, releases the trunk, and selects a trunk among the trunks 38₁ - 38_m after selecting a route via the public telephone network 20 with reference to the memory 34. Moreover, the exchange 10 originates a call, by using the re-origination control part 32₃, with the dial information (123-4567) of the user B which is stored in the memory 34.

[0020]

Next, the configuration shown in Fig.3 will be described in detail with reference to sequence charts shown in Figs.5-9.

Fig.5 shows a sequence chart when a route is not switched. When the telephone terminal 26 originates a call to the user B (S1), the exchange 10 stores the telephone number (123-4567) of the user B in the memory 34 (S2) and selects the least expensive route by LCR controlling with the telephone number (S3). When a route via the Internet is selected by LCR controlling, the exchange 10 originates a call to the user B from a trunk selected among the trunks 36₁ - 36_n through the switch 30 (S4). The Internet gateway 16 converts the telephone number (123-4567) of a user B into the IP address of the personal computer 22 (S5). Then, the Internet gateway 16 starts to connect to the personal computer 22 by using address resolution protocol (ARP) via the Internet 18 (S6) and sends a ring back tone (RBT) to the exchange 10 (S7). The exchange 10 sends the ring back tone (RBT) to the telephone terminal 26 (S8). When a TCP/IP link is

established between the Internet gateway 16 and the personal computer 22 (S9), the line between the telephone terminal 26 and the Internet gateway 16 is connected (S10). The Internet gateway 16 and the
5 personal computer 22 communicate with each other by using UDP in step 12 such that a communication between the telephone terminal 26 and the personal computer 22 starts. At the time, conversion processes between voice and packets are carried out
10 in the voice conversion part 42 of the Internet gateway 16 and in the personal computer 22 (S11,13). When the connection between the telephone terminal 26 and the exchange 10 is disconnected (S14), the trunk of the exchange 10 is released (S15) and the
15 TCP/IP link is released (S16). Then, the call is completed.
[0021]

Fig.6 shows a sequence chart when a route is switched by a switch method of an on-hook
20 operation and dialing a special number or pushing a button. The switch method corresponds to one of the above-mentioned switch methods by a simple operation. As shown in Fig.6, when the telephone terminal 26 is connected to the personal computer 22 via the
25 Internet 18 in steps 11-13, the connection between the telephone terminal 26 and the exchange 10 is disconnected (S14) as a result of an on-hook operation at the telephone terminal 26 (S17). Then, the exchange 10 releases the trunk (S15) and the
30 TCP/IP link between the Internet gateway 16 and the personal computer 22 is released. As a result, the call is completed. Next, by dialing a special number (a predetermined special number) (S18) or by pushing a button (S19) at the telephone terminal 26,
35 the exchange 10 performs the LCR controlling with the telephone number (123-4567) of the user B stored in the memory 34. The LCR controlling is carried

out by functions of the LCR control part 32₁, the switch control part 32₂, and the re-origination control part 32₃ in the control part 32. Then, the exchange 10 selects a trunk among the trunks 38₁ - 38_m for connections via the public telephone network 20. Next, the telephone number (123-4567) of the user B is sent to the public telephone network 20 (S20) and arrives at the telephone terminal 24 (S21). Then, the telephone terminal 24 rings. When the user B responds (S22), the line is connected (S23) and a call between the telephone terminal 26 and the telephone terminal 24 starts.

[0022]

As mentioned above, since a network can be switched by a simple operation, the caller does not need to redial another number after disconnecting a connection for continuing a call when the speech quality of a call via the Internet degrades.

Fig.7 shows a sequence chart when a route is switched by a switch method performed by a hooking operation and dialing a special number or pushing a button. The switch method is also one of above-mentioned switch methods by a simple operation. As shown in Fig.7, when the telephone terminal 26 is connected to the personal computer 22 via the Internet 18 in steps 10-13, the connection between the telephone terminal 26 and the exchange 10 is disconnected (S14) as a result of dialing a special number or pushing a button (S25) after a hooking operation at the telephone terminal 26 (S24). Then, the exchange 10 releases the trunk (S15) and the TCP/IP link between the Internet gateway 16 and the personal computer 22 is released. As a result, the call is completed. Next, the exchange 10 performs the LCR controlling with the telephone number (123-4567) of the user B stored in the memory 34. The LCR controlling is carried out by functions of the

LCR control part 32₁, the switch control part 32₂, and the re-origination control part 32₃ in the control part 32. Then, the exchange 10 selects a trunk among the trunks 38₁ - 38_m for connecting
5 routes via the public telephone network 20. Next, the telephone number (123-4567) of the user B is sent to the public telephone network 20 (S20) and arrives at the telephone terminal 24 (S21). Then, the telephone terminal 24 rings. When the user B
10 responds (S22), the line is connected (S23) and a call between the telephone terminal 26 and the telephone terminal 24 starts.
[0023]

As mentioned above, since a network can be
15 switched by a simple operation, the caller does not need to redial another number after disconnecting a line for continuing a call when the speech quality of a call via the Internet degrades.

As shown in Fig.8, when the telephone
20 terminal 26 originates a call to the user B (S1) and the trunk to the Internet is busy (S26), the exchange 10 selects a trunk among the trunks 38₁ - 38_m by the LCR control part 32₁, the switch control part 32₂, and the re-origination control part 32₃ in
25 the control part 32. Then, the telephone number (123-4567) of the user B is sent to the public telephone network 20 (S20), and arrives at the telephone terminal 24 (S21), then the telephone terminal 24 rings. When the user B responds (S22),
30 the line is connected (S23) and a call between the telephone terminal 26 and the telephone terminal 24 starts.
[0024]

As mentioned above, when the trunk to the
35 Internet is busy, since the route is switched to a route via a network other than the Internet automatically, the caller can make a call without

redialing.

As shown in Fig.9, when the telephone terminal 26 originates a call to the user B (S1), the exchange 10 originates a call to the user B from a trunk (S4). The Internet gateway 16 converts the telephone number of the user B into the IP address of the personal computer 22 (S5). Then, the Internet gateway 16 starts to connect to the personal computer 22 by using address resolution protocol (ARP) via the Internet 18. When there is no response of the address resolution protocol (ARP) due to malfunctions of the Internet 18 or the personal computer 22 and the like (S27), or when the TCP/IP link between the Internet gateway 16 and the personal computer 22 is not established (S28), the Internet gateway 16 sends a busy tone (BT) to the exchange 10 (S29). The exchange 10 selects a trunk among the trunks $38_1 - 38_m$ by the LCR control part 32_1 , the switch control part 32_2 , and the re-origination control part 32_3 in the control part 32. Then, the telephone number (123-4567) of the user B is sent to the public telephone network 20 (S20), and arrives at the telephone terminal 24 (S21). Then, the telephone terminal 24 rings. When the user B responds (S22), the line is connected (S23) and a call between the telephone terminal 26 and the telephone terminal 24 starts.

[0025]

As mentioned above, when the connection via the Internet can not be established, since the route is switched to a route via a network other than the Internet automatically, the caller can start a call without redialing.

In the following, the operation of the exchange 10 shown in Fig.3 corresponding to the above-mentioned sequences will be described in detail with reference to a flowchart in Fig.10.

Fig.10 is a flowchart showing the operation of the control part 32 of the exchange 10. In this example, the exchange 10 includes trunks which are connectable to private networks. That is, the

5 configuration shown in Fig.3 further includes a private network and a plurality of trunks which are connectable to the private network, together with the Internet gateway 16, trunks $36_1 - 36_n$ which are connectable to the Internet gateway 16, the public

10 telephone network 20, and trunks $38_1 - 38_m$ which are connectable to the public telephone network 20. When the exchange 10 receives (A) an LCR origination special number (which is a predetermined special number added to a head of a destination number), the

15 exchange 10 receives the destination number and stores it in the memory 34 (S30). Next, an LCR process is performed by the LCR control part 32, with the received number. Then, the exchange 10 selects a trunk among the private network trunk

20 (S32), the public network trunk (S33) and the Internet gateway trunk (S34). Then, the exchange 10 sends the dialing number to the selected trunk and performs origination processing (S35).

[0026]

25 Next, if a connection is established, voice is transmitted (S36). When the exchange 10 detects a busy tone (BT) and is connected to the Internet gateway 16, the exchange 10 loads the destination number from the memory 34 by the switch

30 control part 32, (S37), selects an alternate route (S38) and selects the private network trunk (S39) or the public telephone network trunk (S40). After that, the exchange 10 sends the destination number and performs the origination process (S41). When a

35 connection is established, voice is transmitted to the selected trunk (S42). When the connection is not established, a process such as route switch or

the like is performed.

[0027]

If the exchange 10 receives a connection switch special number (B) instead of the LCR origination special number first, the exchange 10 starts from the step 37 which is a process for loading the destination number from the memory. The processes after the step 37 are the same as those mentioned above.

Fig.11 is a flowchart showing the operation of the Internet gateway 16. When the destination number/IP address converter 44 receives a destination number from the exchange 10 via the line interface 40 (S50), the destination number/IP address converter 44 converts the destination number into the IP address and the Internet gateway 16 makes a request for connection to the Internet (S51). At this time, while the Internet gateway 16 is calling, the Internet gateway 16 sends the ring back tone (RBT) to the exchange 10 (S52). When a link is not established to the personal computer which is called and time-out occurs after step 51, the Internet gateway 16 sends the busy tone (BT) to the exchange (S56). Also, when a link is not established after sending the ring back tone (RBT) (S52), the Internet gateway 16 sends the busy tone (BT) to the exchange 10 (S56).

[0028]

When the link is established after sending the ring back tone (RBT) to the exchange 10 (S52), the Internet gateway 16 notifies the exchange 10 of completion of establishing the connection (S53) and converts a voice signal into packets. Then, the packets are sent to the Internet 18 (S54). When the call is completed, a disconnecting process is performed (S55).

Fig.12 shows an address conversion example

in the address conversion process (S51) shown in Fig.11. The address conversion example will be described with reference to Fig.12 and Fig.13.

[0029]

5 Fig.13 shows a communication system according to a second embodiment of the present invention. In Fig.13, a telephone terminal 80 of a user C is connected to an exchange 70 (7720 station). The exchange 70 is connected to an Internet gateway
10 74 (7721 station) via an Internet gateway 72 and a private TCP/IP network 78. A telephone terminal 82 of a user D and an exchange 76 (7722 station) is connected to the Internet gateway 74. A telephone terminal 84 of a user E is connected to the exchange
15 76. The Internet gateway 72 is connected to a personal computer 86 of a user F via the Internet 18. The apparatuses have the following addresses: the telephone terminal 80:2000, the exchange 70:7720, the Internet gateway 74:7721 and IP address 1, the
20 exchange 76:7722, the telephone terminal 82:2001, the telephone terminal 84:2002, the personal computer 86:IP address 2. The telephone number of the user F is 044-777-1212.

[0030]

25 ① in Fig.12 will be described with reference to Fig.13. When the telephone terminal 80 sends 7721-2001 to the exchange 70 to originate a call to the telephone terminal 82, the Internet gateway 72 receives 7721-2001 from the exchange 70,
30 and converts it into 7721-IP address 1-2001 as shown in ① in Fig.12. Then, the Internet gateway 72 sends the converted address to the Internet gateway 74. As a result, the Internet gateway 74 is connected to the telephone terminal 82 and a call
35 starts.

[0031]

Next, ② in Fig.12 will be described with

reference to Fig.13. When the telephone terminal 80
sends 7721-2002 to the exchange 70 to originate a
call to the telephone terminal 84, the Internet
gateway 72 receives 7721-2002 from the exchange 70,
5 and converts it into 7721-IP address 1-2002 as shown
in ② in Fig.12. Then, the Internet gateway 72
sends the converted address to the Internet gateway
74. As a result, the Internet gateway 74 is
connected to the telephone terminal 84 and a call
10 starts.
[0032]

Next, ③ in Fig.12 will be described with
reference to Fig.13. When the telephone terminal 80
sends 044-777-1212 to the exchange 70 to originate a
15 call to the personal computer 86, the Internet
gateway 72 receives 044-777-1212 from the exchange
70, and converts it into IP address 2 as shown in ③
in Fig.12. Then, the Internet gateway 72 sends the
converted address to the Internet 18. As a result,
20 the Internet gateway 72 is connected to the personal
computer 86 and a call starts.
[0033]

In the following, a computer readable
medium storing an exchange control program as
25 claimed in claim 8 will be described. The memory 34
stores a program for operating the control part 32
according to the flowchart shown in Fig.10. A
conventional exchange can be used as the exchange of
the present invention by installing the program in a
30 memory of the conventional exchange. The memory 34
can be realized by a computer readable medium such
as an electronic memory, a hard disk, a magneto-
optic disk and the like.
[0034]

35 In the above-mentioned description, the
public telephone network 20 can be a wired network
or a wireless network. In addition, a plurality of

different networks can be used other than the Internet and the public telephone network 20. Moreover, the private TCP/IP network 78 can be the Internet 18.

5 [0035]

[Advantage of the Invention]

According to the exchange described in claim 1, it becomes easy to connect to the called party via the Internet or, for example, via the public telephone network by supplying a telephone number of a telephone terminal. Therefore, a caller does not need to know each destination number for each network. The caller needs to know only one number.

15 [0036]

According to the exchange described in claim 2, since a call via the Internet can be switched to one via a network other than the Internet easily by a simple operation, the caller does not need to disconnect a connection and redial a number when the speech quality of the call via the Internet degrades. The caller does not need to know destination number specific to a network. The caller needs to know only one number.

25 [0037]

According to the exchange described in claim 3, the exchange automatically selects the least expensive network from a plurality of connectable networks including the Internet with a telephone number of a telephone terminal of the called party. Therefore, a caller does not need to know each destination number for each network for selecting the least expensive network. The caller needs to know only a telephone number. In addition, the telephone charge for a long distance call can be reduced since the least expensive network is automatically selected. The caller does not need to

know destination number specific to a network. The caller needs to know only one number.

[0038]

5 According to the exchange described in
claim 4, since the exchange can switch a call via
the Internet to a call via a network other than the
Internet in response to dialing a special number or
pushing a button after an on-hook operation by a
caller, the caller does not need to disconnect a
10 connection and redial a number when the speech
quality of the call via the Internet degrades. The
caller does not need to know destination number
specific to a network. The caller needs to know
only one number.

15 [0039]

According to the exchange described in
claim 5, since the exchange can switch a call via
the Internet to a call via a network other than the
Internet in response to dialing a special number or
20 pushing a button after a hooking operation by a
caller, the caller does not need to disconnect a
connection and redial a number when the speech
quality of the call via the Internet degrades. The
caller does not need to know destination number
25 specific to a network. The caller needs to know
only one number.

[0040]

According to the exchange described in
claim 6, when the route via the Internet is busy,
30 since the route is switched to a route via a network
other than the Internet and the exchange originates
a call automatically, the caller can make a call
without redialing. The caller does not need to know
destination number specific to a network. The
35 caller needs to know only one number.

[0041]

According to the exchange described in

claim 7, when the connection via the Internet can not be established due to a malfunction of the Internet and the like, since the route is switched to a route via a network other than the Internet and the exchange originates a call automatically, the caller can make a call without redialing. The caller does not need to know destination number specific to a network. The caller needs to know only one number.

10 [0042]

According to the exchange control program recording medium described in claim 8, by storing a program recorded in this program recording medium in a memory in an existing switch, the above-mentioned effects can be obtained for the existing switch.

[Brief Description of Drawings]

[Fig.1]

A diagram showing an example of a conventional internet telephone system;

20 [Fig.2]

A block diagram of a communication system according to a first embodiment of the present invention;

[Fig.3]

25 A block diagram of an exchange 10 and an Internet gateway shown in Fig.2;

[Fig.4]

A diagram of a software configuration of the Internet gateway shown in Fig.1 or Fig.2;

30 [Fig.5]

A sequence chart showing an operation according to the first embodiment of the present invention when a route is not switched;

[Fig.6]

35 A sequence chart showing an operation according to the first embodiment of the present invention when a route is switched by an on-hook

operation;

[Fig.7]

5 A sequence chart showing an operation
according to the first embodiment of the present
invention when a route is switched by a hooking
operation;

[Fig.8]

10 A sequence chart showing an operation
according to the first embodiment of the present
invention when a route via the Internet is busy;
[Fig.9]

15 A sequence chart showing an operation
according to the first embodiment of the present
invention when a link via the Internet is not
established;

[Fig.10]

A flowchart showing an operation of a
control part of the exchange;

[Fig.11]

20 A flowchart showing an operation of the
Internet gateway in the embodiments;

[Fig.12]

Tables showing an example of address
conversion in an address conversion process shown in

25 Fig.11;

[Fig.13]

A block diagram of a second embodiment of
the present invention.

[Description of Reference Numerals]

30 10,70,76 exchange

16,72,74 internet gateway

18 the Internet

20 public network

24,26,80,82,84 telephone terminal

35 22,86 personal computer

12,14,36,38 trunk

32 control part

34 memory
40 circuit interface
42 voice conversion
44 destination number/IP address converter
5 50 interface
52 voice processing
54 communication protocol processing part
56 device driver
58 voice processing management part
10 60 line management part
62 connection control
64 application
66 database
78 private TCP/IP network
15

20

25

30

35

[Title of Document] Abstract

[Abstract]

[Problem] It an object, in an exchange allowing
speech communication via the Internet, to originate
5 a call by using a telephone number, switch to a call
via another route by a simple operation when speech
quality degrades, and originate a call.

[Solving Means] A network including the Internet is
selected by a telephone number of a called party,
10 and when internet speech quality degrades during
speaking via the Internet, a telephone terminal of
the called party is called via a network other than
the Internet and a call is started by on-hook
operation or by dialing a special number after
15 hooking by a caller. When call origination via the
Internet is busy or the called party does not
respond, the network is switched from the Internet
to a network other than the Internet and a call is
originated.

20 [Selected Drawing] Fig.2

FIG. 1 ~~PRIOR ART~~

a diagram showing an example of a
conventional internet telephone system

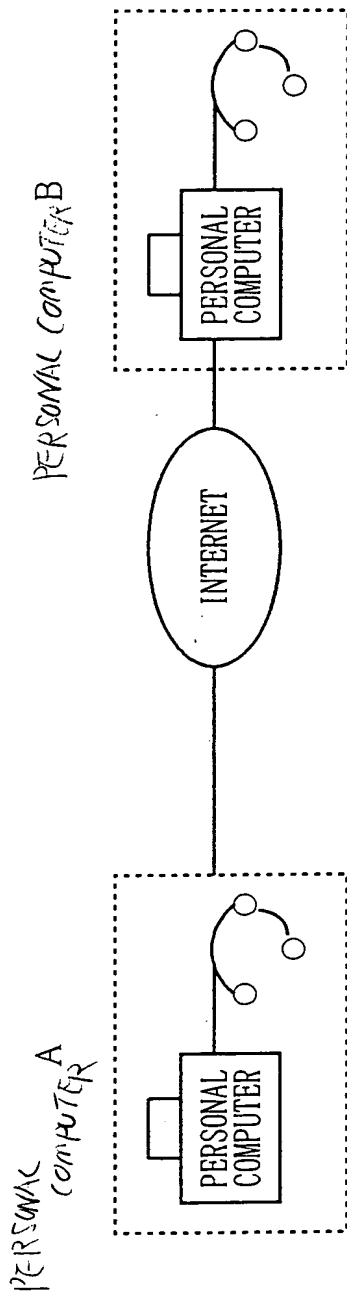
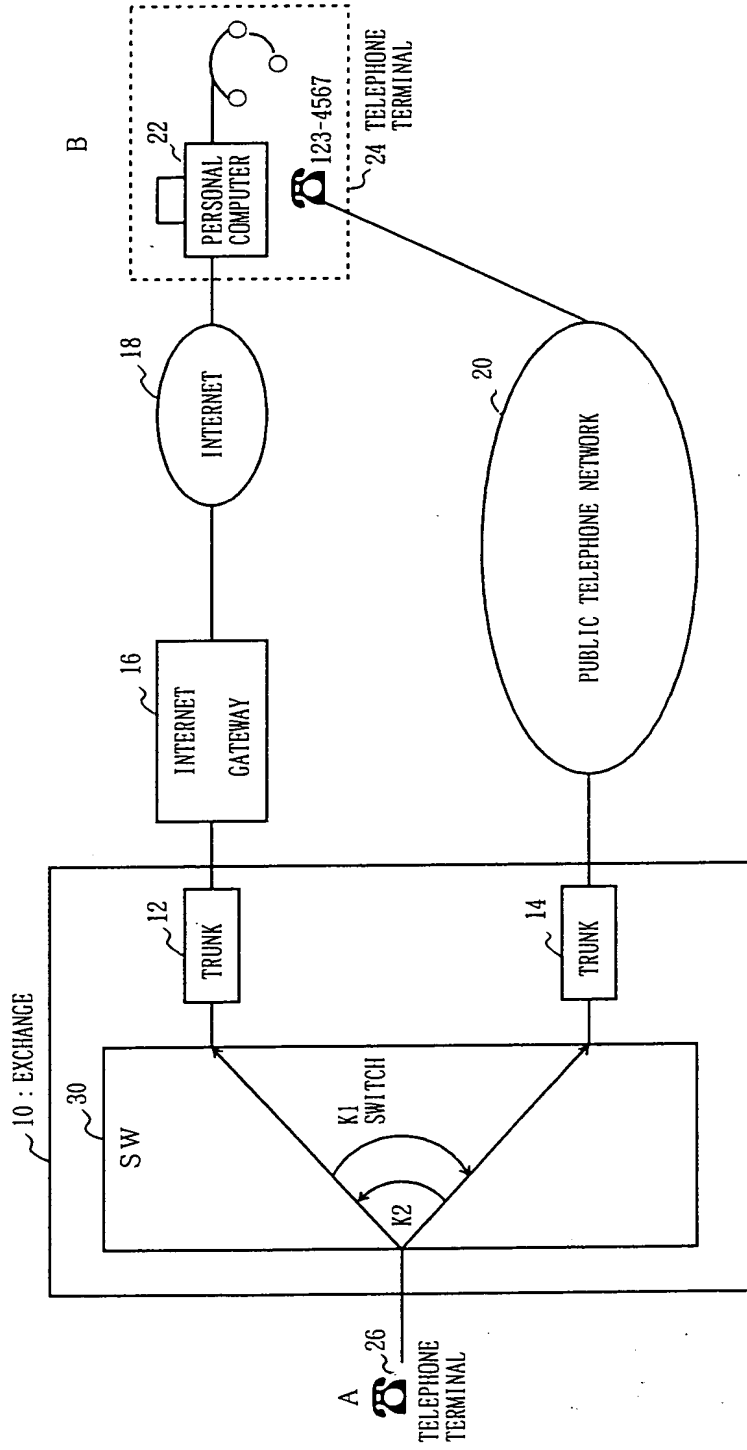


FIG. 2

First embodiment of the present invention



A block diagram of an exchange
and an Internet gateway shown in Fig. 2

FIG. 3

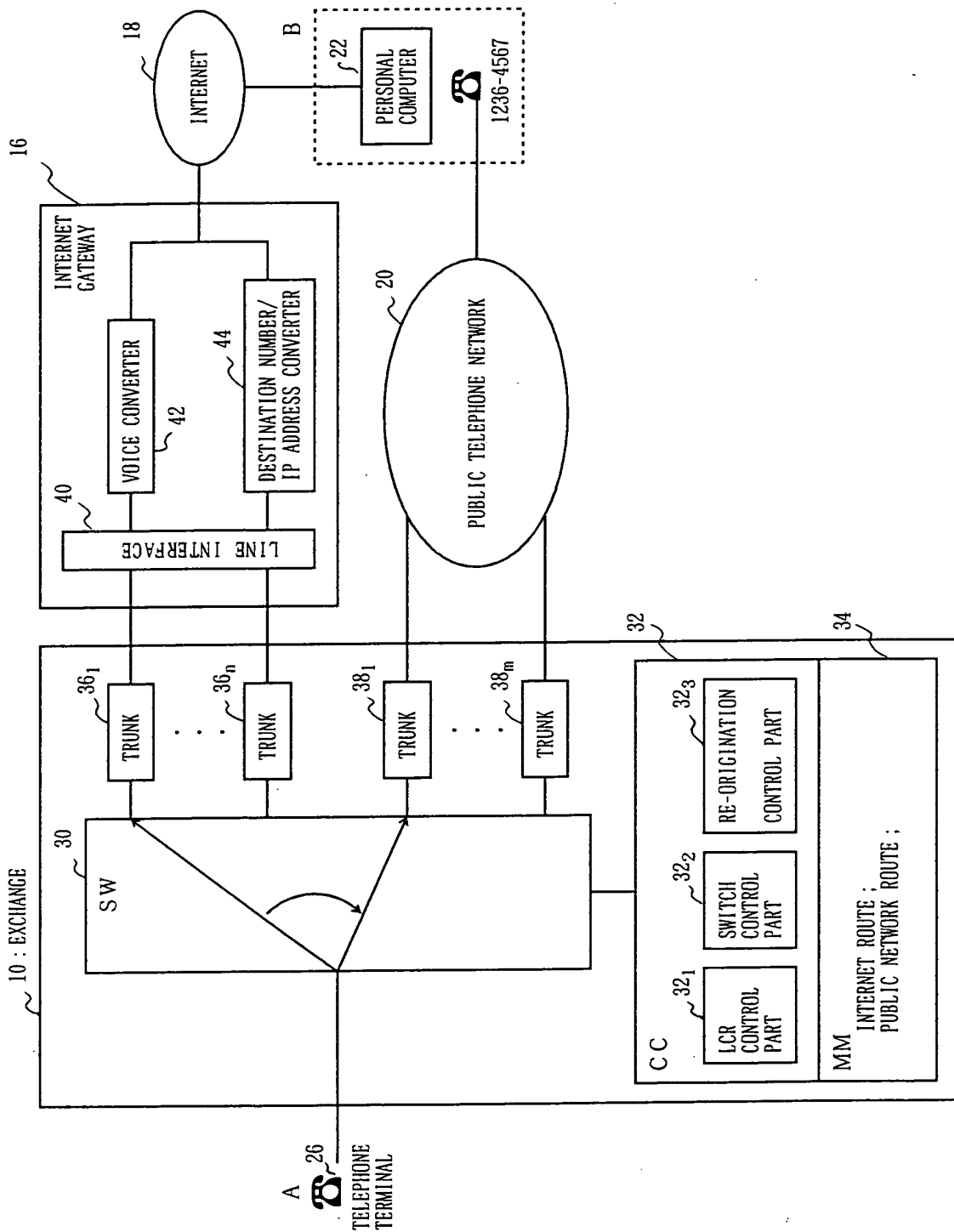
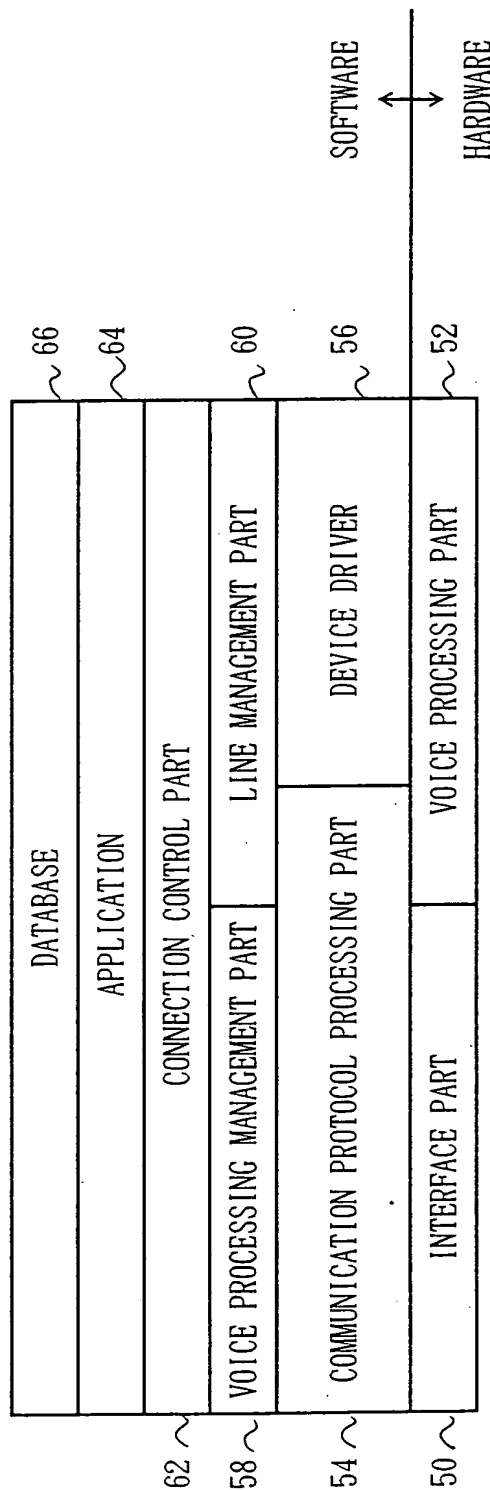


FIG. 4

A diagram of a software configuration of
 the Internet gateway shown in Fig. 1 or Fig. 2

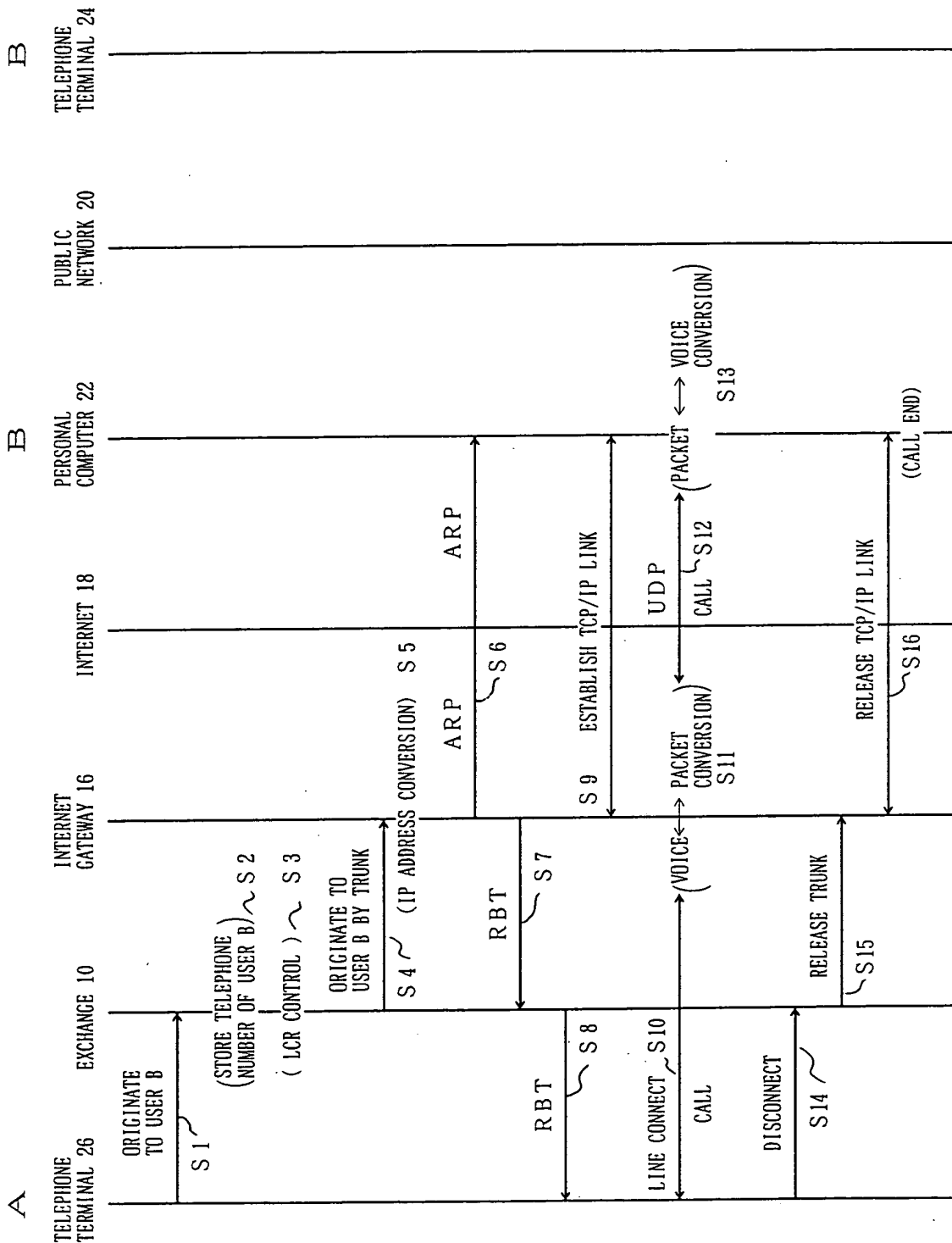


A sequence chart according to

the first embodiment of the present

FIG. 5

invention (when a route is not switched)



A sequence chart according to

the first embodiment of the present

FIG. 6

invention (when a route is switched by an on-hook operation)

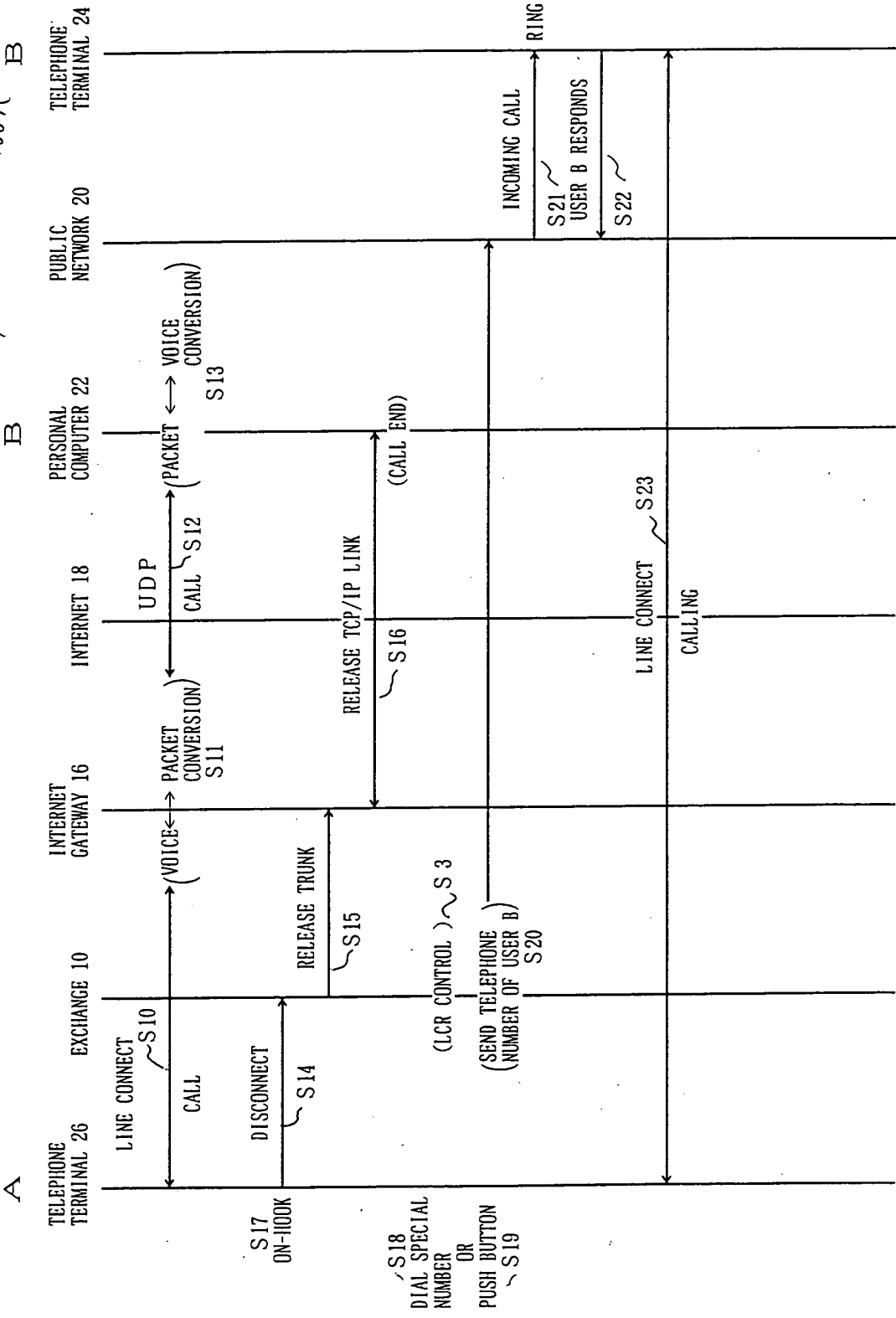
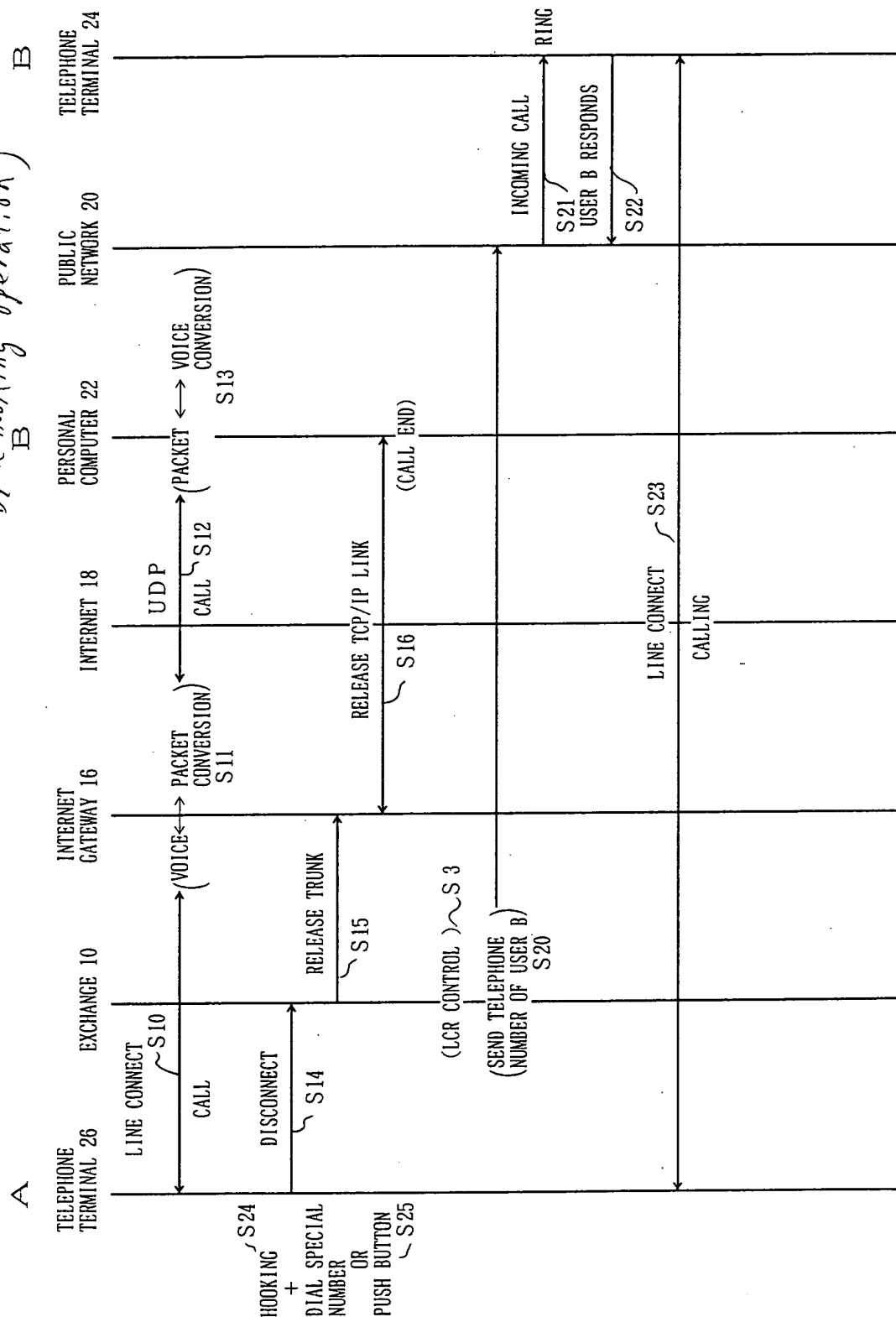
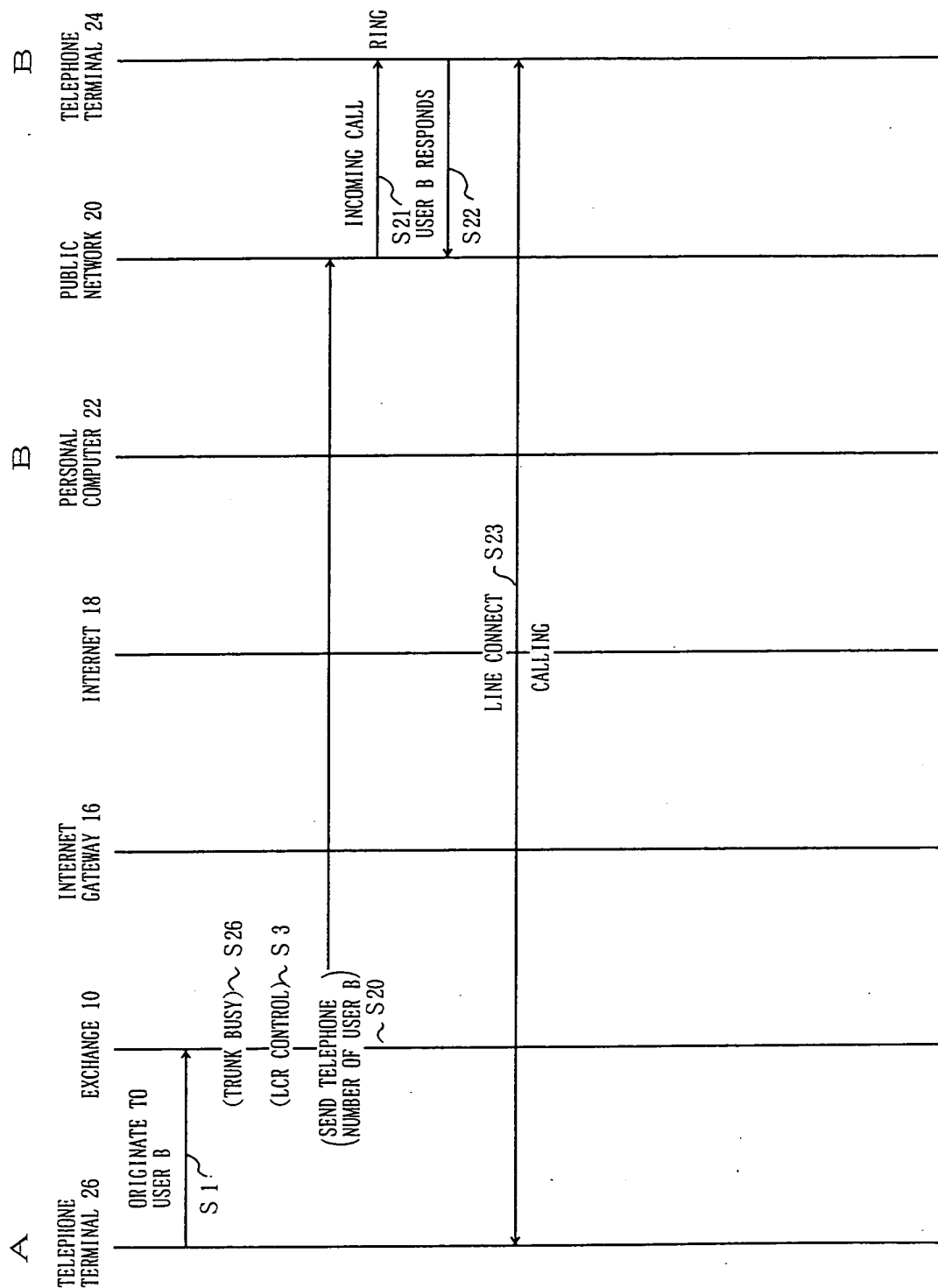


FIG. 7



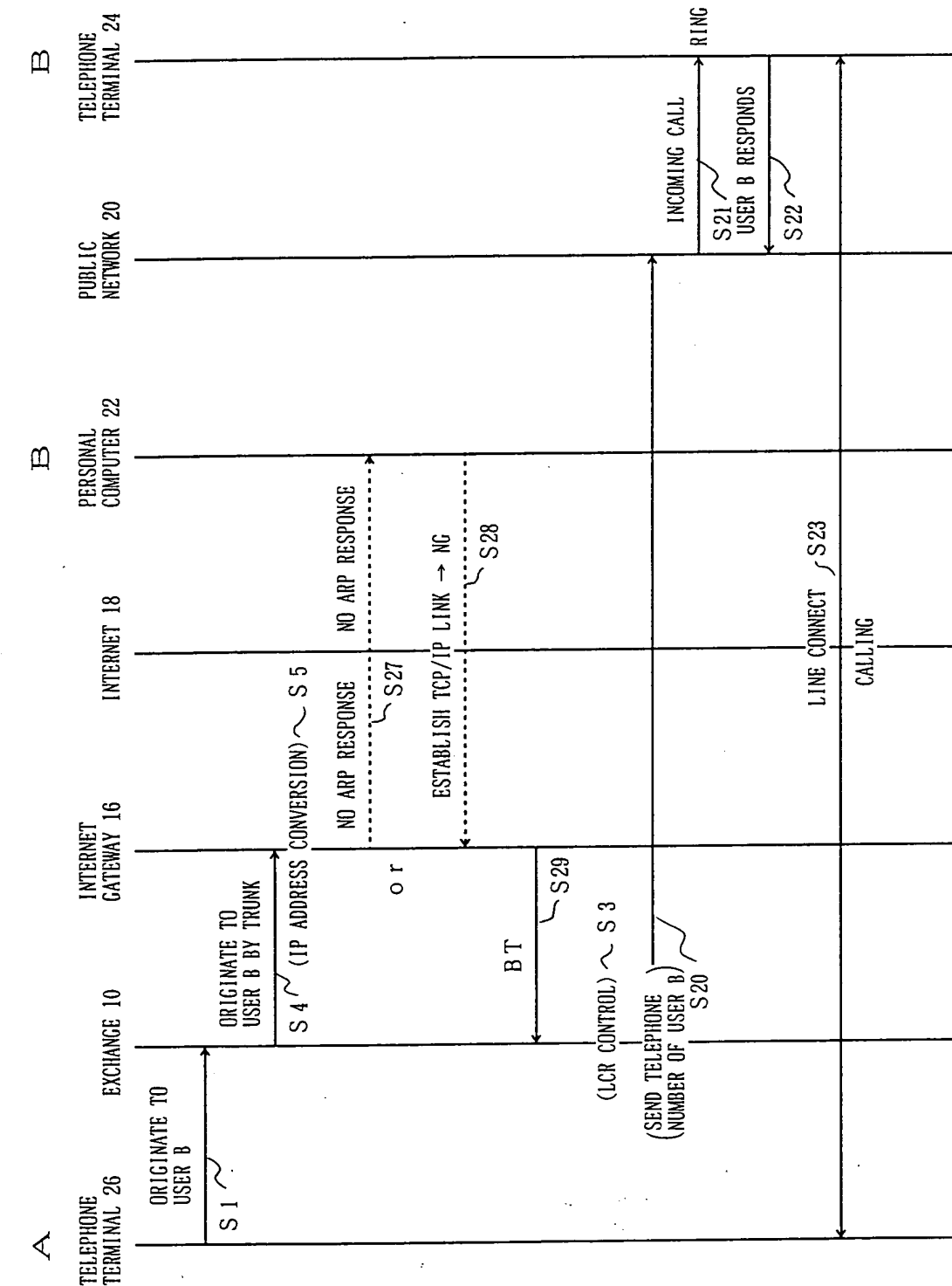
A sequence chart according to
the first embodiment of the present invention
(when a route via the Internet is busy)

FIG. 8



A sequence chart according to the first
 embodiment of the present invention
 (when a link via the Internet is not established)

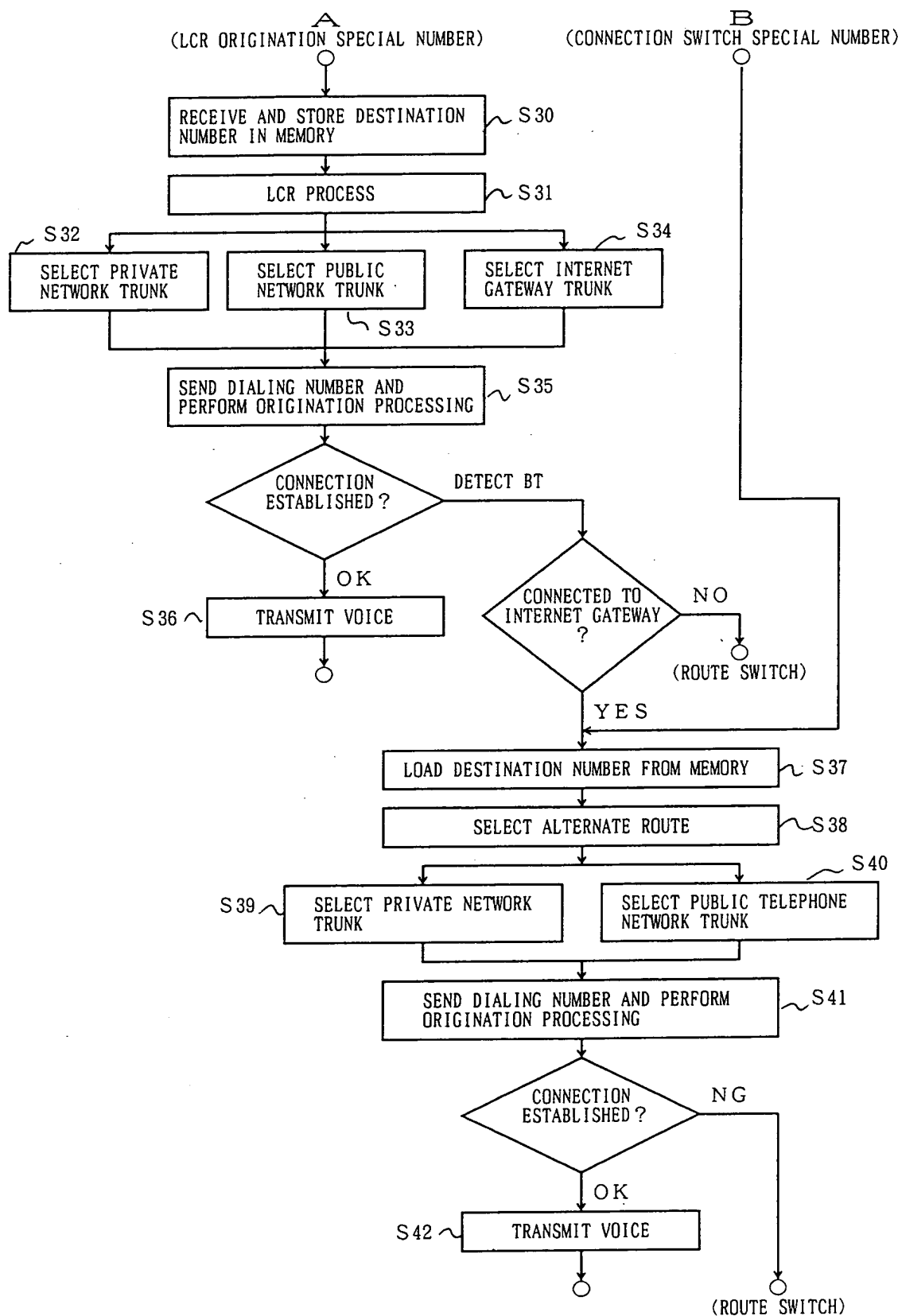
FIG. 9





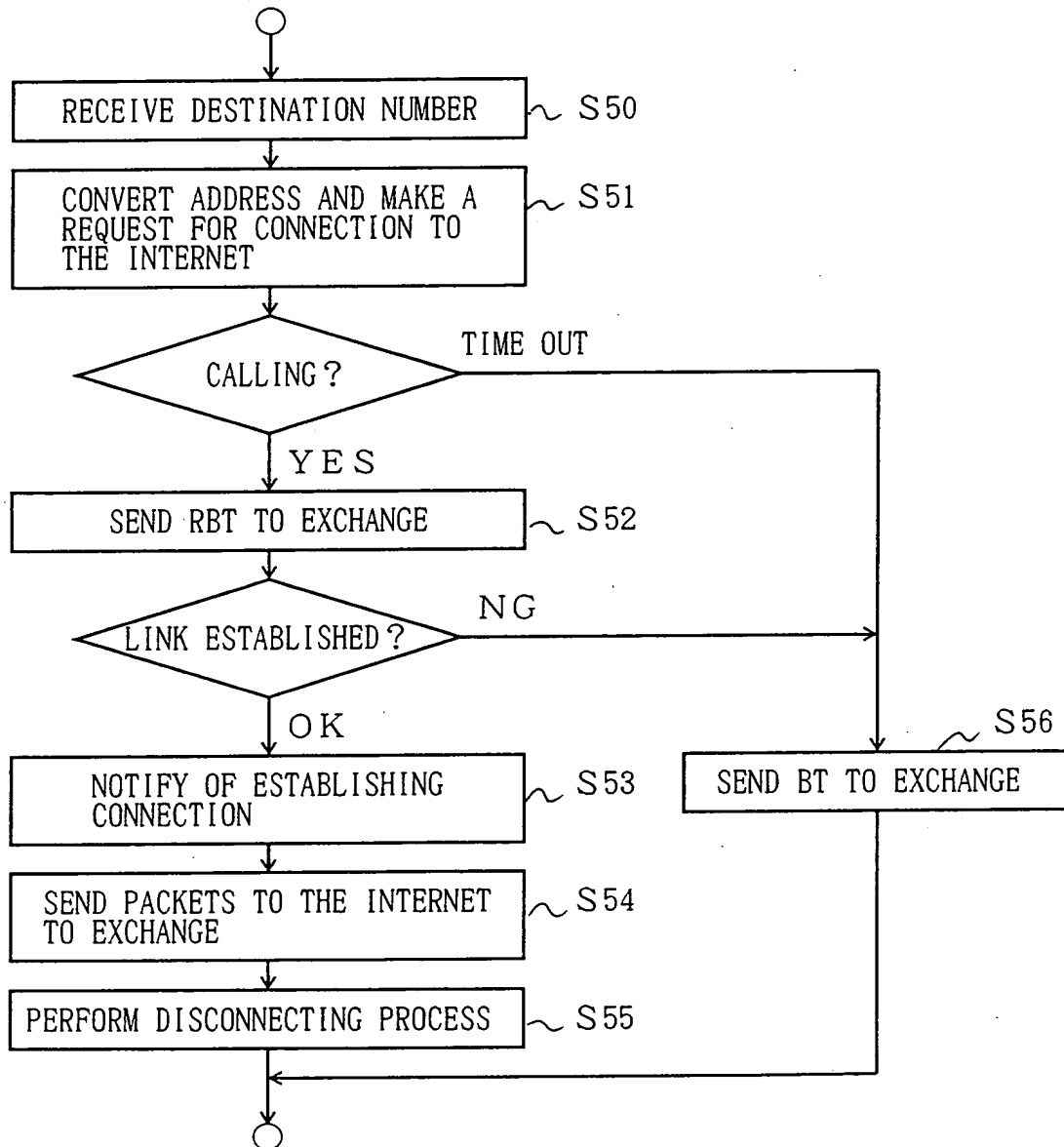
A flowchart of an operation in a control part of the exchange according to an embodiment of the present invention

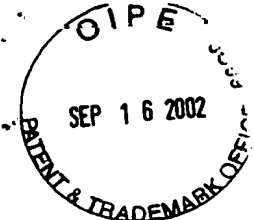
FIG. 10



A flowchart of an operation of the Internet gateway
in the embodiments

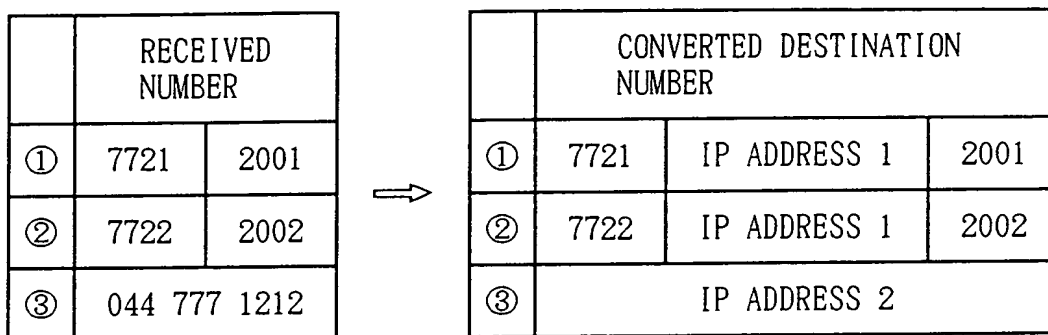
FIG. 11





Example of address conversion in address conversion process shown in Fig. 11

FIG. 12



A block diagram of a second embodiment of the present invention

FIG. 13

